

Highway Maintenance Grabs a Bigger Share

"The cost of maintaining the modern highway system we have built is the most critical problem confronting state highway administrators today," says Michigan highway director Henrik E. Stafseth.

"Inflation, more highways, heavier traffic, greater demand for services, the squeeze on budgets to meet construction priorities and growing legislative pressure for improved fiscal and administrative practices, have all compounded what once was a relatively simple task of plowing, mowing, and filling pot-holes," Stafseth says.

According to Bureau of Public Roads estimates, between 1973 and 1985, it will cost states, counties and municipalities an average of \$5.8 billion a year to maintain all roads and streets in the country (over 3.7 million miles) with needs rising about 60% over current demands. BPR claims it will cost over \$270 million a year, or \$6,400 a mile, just to maintain the 42,500-mile Interstate system when it's completed. "The present trend to spend an increasing proportion of available funds for maintenance is jeopardizing future highway construction," says Stafseth.

In a survey completed for the American Association of State Highway Officials, Washington-based consultants Bertram D. Tallamy Associates measured 28 test sections to determine average Interstate highway maintenance requirements. According to the survey, 47.7% of the cost of total manpower and equipment requirements are for traffic services (snow and ice removal, rest areas and signs); 28.2% for esthetic

controls (litter collection, mowing and landscaping); and only 24.1% for physical maintenance (structures, drainage and paving). The report further divides requirements for labor, equipment and material at 49%, 27% and 24% respectively.

And the cost of maintaining roads is going to get worse if antiquated maintenance practices are allowed to continue, according to many state highway officials. Among inefficient practices are overstaffing to meet emergencies and failure to standardize operations statewide.

Many highway departments once allocated as little as 10 to 15% of their budgets to maintenance. Today, most are spending over 30% for maintenance and the full impact of giving

very little attention to primary and secondary roads while building the Interstate system has yet to hit the states. According to BPR estimates, between 1973 and 1985 state highway departments will be allocating almost 50% of their budgets annually just for maintenance.

• **Effective management**—In many cases, routine modern management techniques are not being applied to hold down costs.

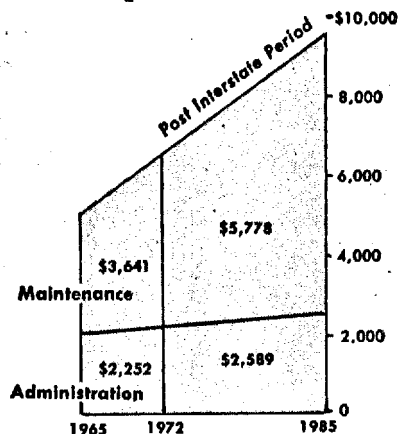
Highway management consultants Roy Jorgensen Associates Inc., of Gaithersburg, Md., estimate that 20 to 30% of current maintenance costs could be eliminated by operational efficiency. "States will have to adopt better methods of planning and scheduling work as well as developing statewide education and information exchange programs," according to the firm's president, Roy E. Jorgensen, former chief engineer of the Connecticut highway department.

Jorgensen says, "Maintenance budgets should be based on measurable work quantities, such as cubic yards or tons of patching and acres of mowing. Labor, equipment and materials can then be allocated in the budget to meet the work needs, based on standard productivity rates. But this will require changes in maintenance operations that are sure to meet with stiff opposition."

Implementation of a modern management program means that maintenance officials will have to define quality and quantity performance; plan and schedule activities on a long-range and daily

Soaring road upkeep costs . . .

Average Annual Costs—\$ millions



. . . Compound needs

| Improvement costs per year (\$ millions) | | |
|--|--------------|---------------|
| | 1965-1972 | 1973-1985 |
| Highway system | 2,937 | 286 |
| Interstate | 2,937 | 286 |
| Other federal-aid | | |
| (Primary) | 2,371 | 5,556 |
| Federal-aid secondary | | |
| (State) | 644 | 2,626 |
| Federal-aid secondary | | |
| (Local) | 390 | 1,418 |
| Other state | | |
| Highways | 222 | 1,108 |
| Other local | | |
| Roads & streets | 1,930 | 6,370 |
| TOTAL | 8,494 | 17,364 |
| 1963 base year—Bureau of Public Roads | | |



Michigan's Stafseth

Consultants view upkeep as a problem today.



Minnesota's Murchie

Minnesota's Murchie

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basis; and establish the relationship for methods, use of time and productivity of labor and equipment under varying conditions.

One state highway department that believes in Jorgensen's methods is Louisiana (ENR 8/7 p. 52). Last summer it adopted a statewide maintenance management program that his firm developed after a two-year study of the department's operations. It defines work activities, sets maintenance standards, requires annual updating of the maintenance program and allocation of resources, simplifies work scheduling and reporting procedures and provides for training supervisors to schedule according to the work program and standards.

According to assistant highway director A. B. Ratcliff, "Jorgensen estimated that we could save about \$6 million by adopting its maintenance management proposals. We've had the program in effect only six months, but we already are projecting a \$12-million saving, or 25% of our fiscal 1968 costs."

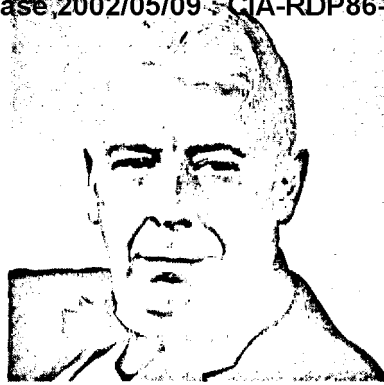
James Murchie, Minnesota's assistant commissioner for maintenance, says, "There's no question that outside consultants bring some sort of managerial knowledge to the organization that you don't have yourself. We've had eight management consultants since 1965 helping us with our organization work, improvement and other problems."

"As a result of their work, we now operate on a programmed budget system, which requires development of a standard unit to determine quality and quantity for every item in our maintenance program," says Murchie. "It has taken us about three or four years to put almost 80% of our work under the system. We're still working on some areas."

"But, in order to operate a maintenance department efficiently, you have to have effective management," he adds. "And this is where we place the emphasis, training our engineers to go beyond their technical abilities and develop managerial abilities."

Maintenance management in Minnesota is compulsory in all state departments. According to Murchie, "In the next legislative session, they'll only consider allocation of funds on programmed budgets."

• **Maintenance inefficiencies**—The most critical factor hindering operations is that the many highway maintenance departments remain the last stronghold of the patronage system. Some states already have either dropped or are phasing out the traditional spoils system of appointing maintenance personnel to pay off political debts. Others, such as West Virginia, Georgia and Indiana, have not, but are making headway. Georgia, for instance, recently appointed a professional administrator to fill the executive assistant director of highways



Oregon's Cooper
Maintenance Isn't washing dishes.

spot, and all upper echelon jobs are now being filled only by graduate engineers.

Another basic cause of inefficiency is the lack of research to produce better methods, equipment and materials to do the job properly. For example, highway departments remove snow and ice from their roads in much the same way they did 40 years ago. It's only been within the past five years that any serious consideration has been given to maintenance research. Recently, AASHO let contract studies in 20 different areas of highway maintenance, and individual states are conducting many more on their own.

Other problems besetting highway maintenance organizations include:

- Inadequate data on field activities.
- Nonuniform standards or lack of standards.
- Ineffective procedures for planning and scheduling work.
- Widely varying quality, productivity and unit costs for field activities.
- Ineffectual means of comparing actual and desired quality, service level and unit cost for maintenance activities.
- Lack of reliable means to forecast long-range maintenance requirements or to evaluate alternative policies.

Progress toward effective management already has been made by some highway departments including setting realistic standards, developing computer-based methods for planning, scheduling and controlling the maintenance activity and determining cost effectiveness as a measure for setting maintenance levels and priorities. Some, such as Pennsylvania, Oregon and Texas, have in-house study groups revamping maintenance operations.

Pennsylvania highway secretary Robert G. Bartlett says preliminary reports indicate that programmed maintenance operations can be increased from the present 11% to about 80% of all maintenance activity. "Development of measurable work standards permits us to plan and program additional work items and also provides for computerized measurement of accomplishments to programmed activity," he says.

management is good politics. Improved management procedures, properly conceived and developed, can be sold to policy makers."

According to Oregon state highway engineer Forrest E. Cooper, "Too many engineers think that maintenance is washing the dishes. It's not. It's doing the best job for the dollar. And in order to do the best job, we have an internal management analysis section, a three-man unit that looks into any area where improvement seems likely. To date, a number of drastic changes have been made, notably in reduction of shop personnel, never politically easy to do."

In Texas, the highway department has its management people all over the state attending specially devised maintenance management programs at nearby universities and technical colleges. J. C. Dingwall, state highway engineer, says, "Management runs right clear down to the section foreman, with all our personnel getting training in technology."

• **Setting up the programs**—Elsewhere, states have called in outside consultants; some to merely set up maintenance management programs, some to stay on and guide the department in implementing the newly established program. State approaches differ:

• Utah director of highways Henry C. Helland adopted a consultant's recommended maintenance management program two years ago. "We have been able to reduce personnel by 100 or so workers in areas of inefficiency. Another 10% of our workforce, lost through attrition, has not had to be replaced," he says. Helland is optimistic that increased efficiency resulting from the new system eventually will overcome future inflationary trends.

• Michigan's Stafseth says, "Our department is currently employing management consultants to develop a program in cooperation with our maintenance staff. We believe private consultants can provide an outside evaluation of an existing operation which can provide the initial impetus toward improving maintenance operations," he says.

• Virginia highway commissioner and current AASHO president Douglas B. Fugate says, "We've implemented an extensive revamping of our maintenance programs based on recommendations of a private consultant. We don't expect a reduction in overall budget, but the program will be a substantial factor in controlling growth of budget as the maintenance function continues to expand. One area of cutting costs that Virginia is experimenting with is change in road design to reduce the number of roadway joints, eliminating grass shoulders and greater functional landscaping," says Fugate.

• California's highway maintenance engineer Earl E. Forbes says, "We be-

lieve that top level management personnel in maintenance have to be professional engineers and this has to extend down through district maintenance engineer standards. Engineers are trained to think along the lines of evaluation of performance, cost-effect analyses and many other decisions on proper maintenance." He adds, "Our department retains consultants to develop work standards for operation and maintenance that help us to better schedule work, which we believe is the real key to successful operation."

• **Indiana chief engineer Fred L. Ashbaucher** claims that because of high labor and materials costs, plus the increasing annual burden of maintaining new Interstate systems, "We're going more and more to private contracting and finding it less expensive. Our department now employs fewer people than we did in former years, largely because of such private services, and we foresee expansion of the program as one of the keys to good management in the future."

• **Fiscal headache**—Despite all efforts to trim the fat, financing of highway maintenance throughout the U.S. remains a serious problem.

And any thought of obtaining federal aid to do the job seems remote, even under a post-Interstate program.

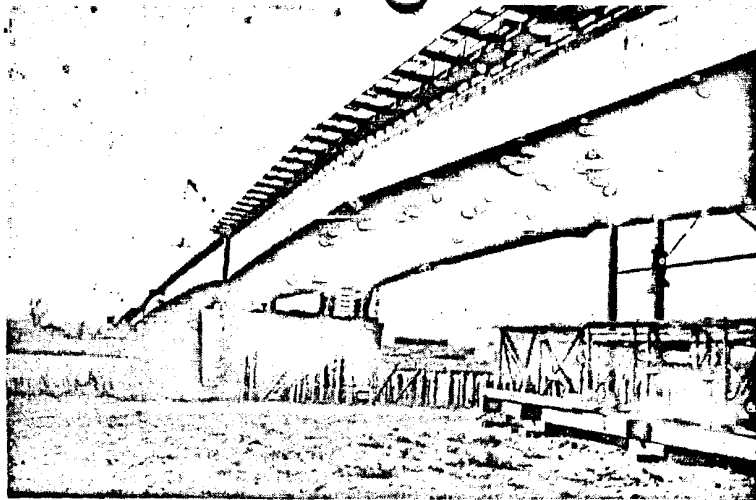
As yet, there are no bills in Congress to aid the states in keeping their highways in good repair. Nor is there likely to be any action in this area on Capitol Hill during this session.

(Some Capitol Hill sources say exploratory moves toward a highway maintenance bill might begin early next year.)

Although states are growing increasingly dissatisfied with skyrocketing maintenance costs and outmoded administrative practices, there is one valve regulating most of the steam emanating from state legislatures: By an official vote, AASHO indicated that state highway administrators want no part of a federal-aid program for highway maintenance. They fear the red tape involved with any federal program, loss of local control and upsetting of the states' political machinery.

Among other roadblocks is a Senate Public Works Committee statement on the general direction of future highway policy. The emphasis of the statement lies in development of urban transportation systems. Nowhere is possible assistance for state highway maintenance mentioned.

The Senate Public Works Committee now is laying ground work for a bridge replacement program. Hearings probably will begin in January along with several aspects of the post-Interstate program, including secondary road improvement. Some funding will probably result, but not for maintenance—yet.



BUCKLED SECTIONS will be replaced 19.5 ft on either side of faults.

Buckled Span Reinforced

Work is under way to strengthen the superstructure of Vienna's Fourth Danube Bridge, which buckled recently during construction (ENR 11/13 p. 11). The contractor had just lifted the webs of the closing section into place when the two main spans of the twin orthotropic box girder structure sagged, causing buckling between the two concrete abutments.

Designer and prime contractor Waagner-Biro AG, of Vienna, has welded I-beams onto the upper flanges of the four web sections to reinforce the center section until the bottom flanges, stiffeners and deck plates are in place. The I-beams also will serve as braces when the superstructure is lowered into place on jacks to straighten deformed sections.

Although four separate investigations of the damage are not yet complete, engineers still feel that a combination of temperature drop and uneven web plate expansion caused by sun exposure increased stress in the bottom flange to build up beyond 13,200 tons. While this load would be light for the completed structure, it apparently proved too great during the crucial construction period.

The stress buildup in the uncompleted center section caused a 2.5-ft drop in elevation, which in turn, buckled the girder and deck at two points near the shore. Under the original construction plans, the contractor was to lower the superstructure, resting on jacks on the piers, about 15.5 ft after the bridge was complete. The sagging reduces this distance to about 12.5 ft.

Waagner-Biro's technical director, Rudolf Heckel, said that the superstructure will be lowered as soon as the center section is completed. This will straighten most of the buckling in the bottom flange, webs and deck plate. The contractor will also replace the prefabricated steel sections 19.5 ft in either

direction from the faults. The sections will go in one at a time, without falsework.

No more loss in elevation has been reported since the mishap occurred on November 7. Officials resumed shipping, rail and road traffic under the structure.

Austrian Bridge Builders Have Second Buckled Span

Viennese officials are not the only red-faced Austrian bridge builders today (see above).

Last week, officials of Brennerautobahn AG, the federal agency building the six-lane Alpine superhighway from Innsbruck to the Brenner Pass, were busy trying to figure out how to save the last bridge built on the 23-mile autobahn from total loss. The concrete piers of its Seebucke (lake bridge) structure have settled differentially almost 5½ ft, causing severe damage to the deck.

Brennerautobahn abandoned original plans to build the roadway around Brenner Lake's western shore across the crest of a rockfill dam that was already under construction. Instead, it brought in a contractor to build a new dam and the bridge adjacent to a double-track railroad and the old Brenner Pass road. They already follow the lake's eastern shore, according to the agency, and construction there seemed less formidable.

However, Victor Fritsch, head of the Austrian Geodynamics Agency, says that aside from being already overloaded, the eastern shoreline is subject to sliding problems. Although the new dam and road were built above design grade to allow for subsidence, differential settling has severely buckled the concrete deck. No decision has been reached on how to save the structure.